

# OPTIMIZING PERFORMANCE: NUTRITIONAL, FITNESS, AND CARDIOVASCULAR ANALYSIS OF MALE VOLLEYBALL PLAYERS

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## Abstract

This study aimed to investigate the nutritional status, body fitness, and heart rate frequency of male volleyball players. The population and sample in this study were all extracurricular participants in men's volleyball totaling 8 people with a sampling technique, namely total sampling. This study used qualitative descriptive type. Based on the results of research that has been conducted, it can be seen that the nutritional status of male volleyball player students is included in the normal category, this has been calculated using the anthropometric formula body mass index (BMI) with the results of 7 respondents or 87.5% with the normal category and 1 respondent or 12.5% in a light thin state, 0 respondents or 0% with the fat category. The TKJI test (physical fitness test) shows that the majority of students are included in the very good category. Based on the results of research that has been conducted, it can be seen that the nutritional status of male volleyball player students is included in the normal category, this has been calculated using the anthropometric formula body mass index (BMI) with the results of 7 respondents or 87.5% with the normal category and 1 respondent or 12.5% in a light thin state, 0 respondents or 0% with the fat category. The TKJI test (physical fitness test) shows that the majority of students are included in the very good category. The results of tests using an oximeter conducted before and after physical activity showed that male volleyball students experienced 100% increased heart rate frequency.

**Keywords:** Nutritional Status, Fitness, Heart Rate Frequency, And Volleyball.

## INTRODUCTION

Volleyball is a sport that requires an optimal balance between physical condition and good nutrition (Blackard et al. 2020; Host and Ivašić-Kos 2022; Moscatelli et al. 2023). Volleyball players, especially those in the men's category, need a high level of fitness to be able to face the physical challenges provided in the game. Adequate nutritional conditions are also very important in supporting muscle recovery, stamina, and overall health (Husen et al. 2022; Peña et al. 2018). Therefore, analysis of nutritional status, body fitness, and cardiovascular response during training is crucial to understanding athlete health and performance in the context of men's volleyball.

A deep understanding of these factors is not only important for improving athletes' performance, but also for reducing the risk of injuries as well as health problems that may arise from intense training (Al Chalouhy et al. 2023; Gregory and Harper 2023; Zhou, Chen, and Muggleton 2020). By identifying specific aspects in nutritional status, fitness, and cardiovascular response, trainers and medical staff can design more specific and effective exercise programs according to individual needs (Millard et al. 2021; Quintana-Cepedal et al. 2022). Therefore, research that combines multidimensional analysis of these aspects becomes relevant in the context of coaching male volleyball athletes, with the main objective of improving athletes'

performance as well as maintaining their health during participation in training and competitions. In addition, a deep understanding of nutritional status, fitness, and cardiovascular response in male volleyball players can also make a significant contribution to the development of sports education at various levels, including in schools (Mortatti et al. 2018; Sarto et al. 2019). By taking holistic care of athletes' health and fitness, educational institutions can design more comprehensive programs to improve students' physical and mental well-being, as well as teach them the importance of a healthy lifestyle and regular physical activity. Thus, this study is not only relevant in the context of athlete coaching, but also has far-reaching implications in education and health promotion among adolescents.

In the modern world of sports, understanding factors such as nutritional status, body fitness, and cardiovascular response is becoming increasingly important in improving athlete performance (ali et al. 2024; Delyana et al. 2024). Volleyball, as one of the sports that requires physical strength and high reaction speed, places its own challenges for its players (Imai et al. 2023; Panda et al. 2022; Zhang and Zhang 2023). Moreover, in the context of men's volleyball players, where the intensity of training and competition is often higher, attention to health and fitness aspects becomes crucial. This background highlights the need for in-depth research to analyze nutritional status, body fitness, and cardiovascular response in male volleyball players, focusing on players at SMAN 4 Madiun City.

SMAN 4 Madiun City is known as one of the schools with a strong sports tradition, including volleyball. As such, this study not only makes an important contribution to the general understanding of athletes' health and fitness, but also has direct implications in the development of sports coaching programs in such schools. By investigating the factors that affect the health and performance of men's volleyball players, the study can assist school coaches and medical staff in designing more effective and sustainable training programs, as well as ensuring the overall well-being of athletes in achieving achievements on the court.

In addition, an in-depth understanding of nutritional conditions, fitness, and cardiovascular responses in men's volleyball players can help identify potential health risks that may arise during practice and competition (Martins et al. 2020; Tanaka and Yasuda 2022). By knowing these factors specifically, schools and coaches can take appropriate preventive measures to reduce the likelihood of injuries or health problems that may occur to athletes (Bafirman et al. 2023; HB et al. 2023; Putra et al. 2023). In addition, the study can also provide insight into the importance of a holistic approach in athlete coaching, where a balance between physical exercise, proper nutrition, and continuous monitoring of health is key to achieving full potential in sports (Montuori et al. 2019; Robles-Palazón et al. 2022). Thus, this research has great relevance in the context of sports development at the school level as well as the coaching of quality athletes. In relation to nutritional status, recent research has highlighted the importance of proper nutrition in improving athlete performance. Study by Bouzid et al. (2018); Lee et al. (2018), Shows that the maintenance of optimal nutrition can improve endurance and muscle recovery, which directly contributes to the improvement of athlete performance. In addition, research by Pakkert et al. (2018); Teahan, Whyte, and O'Connor (2023), highlights the important role of micronutrients such as iron, vitamin D, and omega-3s in supporting athletes' cardiovascular function and fitness. These findings suggest that a deep understanding of nutritional aspects can be a key factor in improving the health and performance of athletes, including

men's volleyball players. On the other hand, in terms of body fitness, recent research has highlighted various evaluation methods and exercise programs that can improve the performance of athletes. Study by Gece et al. (2023); Pineda-Hernández (2022) Demonstrated that both functional and aerobic endurance-based exercise approaches significantly improve fitness and endurance in volleyball athletes. In addition, the use of advanced technologies such as continuous heart rate measurement through wearable devices has become a growing area of research in monitoring cardiovascular responses during training and matches de Almeida-Neto et al. (2023); Al Attar et al. (2022). These findings provide valuable insights for the development of more effective exercise programs and more accurate health monitoring for male volleyball athletes.

A major contribution of the study was to incorporate in-depth analysis of nutritional status, body fitness, and cardiovascular response in male volleyball players, particularly in high school settings. In the context of volleyball, previous studies have tended to focus on one aspect only, while this study integrates all three dimensions comprehensively. This not only provides a more holistic understanding of athletes' health and performance, but also allows the identification of potential linkages between these factors. As such, the study is expected to provide new insights into the complexity of the relationship between nutritional status, body fitness, and cardiovascular response in male volleyball players in a school setting, as well as provide a solid foundation for the development of more effective exercise programs and better coaching of athletes in the future.

## METHOD

The research method used in this study was designed comprehensively to investigate nutritional status, body fitness, and heart rate frequency in male volleyball players at SMAN 4 Madiun City. This study used a qualitative descriptive approach with a sample of 8 male volleyball players selected through total sampling techniques. The data collection steps carried out include measuring body mass index (BMI) using anthropometric formulas, physical fitness tests with the Indonesian Physical Health Test (TKJI), and measuring heart rate frequency before and after physical activity using an oximeter. The total sampling method was chosen to ensure the inclusion of all available male volleyball players at SMAN 4 Madiun City, thus allowing better representation of the population studied. After sample selection, the data are systematically analyzed taking into account certain categories for each of the variables studied. Nutritional status was identified based on BMI criteria, by categorizing respondents into normal, light underweight, or obese categories. Meanwhile, physical fitness test results are assessed based on scores obtained from TKJI, which are then grouped into good, sufficient, or bad categories. Measurement of heart rate frequency before and after exercise using an oximeter provides immediate data on cardiovascular response to physical activity. These data are then statistically analyzed to identify common patterns and differences between different groups, if any, as well as provide a deeper understanding of the relationships between the variables under study. In addition, this study pays attention to strict research ethics, including obtaining permission from the school and obtaining approval from research participants. It aims to ensure that research is conducted with due regard to the principles of security, confidentiality, and the rights of individuals involved in research. All measurement and data collection procedures are carried out with due observance of applicable standards in scientific research, thus ensuring the reliability and validity of the results

obtained. Thus, the methods used in this study are not only comprehensive, but also systematic and pay attention to important aspects in quality scientific research.

## RESULTS AND DISCUSSION

### Test and Measurement Data

The results of data exposure that have been carried out after observation in the field using the Body Mass Index Test (BMI), Indonesian Physical Fitness Test (Tkji) and Heart Rate / Pulse Frequency in male volleyball players of SMAN 4 Madiun City which will be described based on data obtained on the field. The sample of this study amounted to 8 male volleyball players, this study used indicators of weight and height as well as pulse rate.

### Body Mass Index (BMI)

**Table 1: BMI Test Results**

No	Height/ TB	Weight/BB	Result	Information
1.	174	58	19.15	Usual
2.	175	63	20.57	Usual
3.	172	53	17.90	Skinny (light level)
4.	173	61	20.38	Usual
5.	171	59	20.17	Usual
6.	170	57	19.72	Usual
7.	177	61	19.47	Usual
8.	177	66	21.06	Usual

The results above showed that male volleyball players of SMAN 4 Madiun City had a body mass index with a result of 87.5% under normal circumstances and 12.5% of respondents in a thin state (light level).

### Indonesian Physical Fitness Test (TKJI)

**Table 2: TKJI Test Results**

No	sprint	Pull up	Sit up	Vertical jump	Moderate distance running 1200m	Value	Description
1.	05.93d (5)	8 (2)	30 (4)	270 (5)	3.9 (5)	21	Good
2.	05.55d (5)	20 (5)	32 (5)	275 (5)	2.60 (5)	25	Very good
3.	05.52d (5)	22 (5)	29 (3)	256 (5)	2.91 (5)	23	Very good
4.	05.37d (5)	24 (5)	30 (4)	270 (5)	2.98 (5)	24	Very good
5.	05.64 (5)	15 (4)	30 (4)	261 (5)	3.05 (5)	23	Very good
6.	05.46 (5)	17 (4)	30 (4)	263 (5)	3.10 (5)	23	Very good
7.	04.76 (5)	12 (3)	32 (4)	283 (5)	2.54 (5)	22	Very good
8.	04.85 (5)	13 (3)	30 (4)	288 (5)	2.40 (5)	22	Very good

From the results of the Indonesian physical fitness test, it showed that the male volleyball players of SMAN 4 Madiun City at their fitness level experienced 87.5% in the very good category and 12.5% in the good category.

## Pulse Frequency

Below are the test results of the frequency of heart rate / pulse before and after physical activity using an oxymeter measuring instrument.

**Table 3: Heart rate/pulse test results**

No	Before (bpm)	After (bpm)	Information
1.	99/88	97/112	Increase
2.	99/92	98/119	Increase
3.	98/81	99/109	Increase
4.	98/63	98/70	Increase
5.	97/93	98/124	Increase
6.	98/76	97/114	Increase
7.	98/70	98/96	Increase
8.	98/58	98/101	Increase

Hasil dari penghitungan oxymeter untuk pengukuran frekuensi denyut nadi menunjukkan bahwa siswa putra SMAN 4 Madiun City mengalami 100% peningkatan frekuensi denyut jantung/nadi setelah melakukan aktifitas fisik.

## Data Analysis

This study aims to determine the relationship or correlation of nutritional status in body fitness and the relationship of body fitness with the frequency of heart rate / pulse of male volleyball players of SMAN 4 Madiun City. This study used data analysis techniques guided by anthropometric formulas to determine the results of body mass index (BMI) in students aged 16-19 years, for fitness using the Indonesian physical fitness test (TKJI) and to determine the pulse frequency using an oxymeter before and after physical activity. Here are some analysis results using SPSS with the crosstabulation method to determine the relationship between variables.

**Table 4: Crosstab Data Analysis Results**

Descriptive Statistics				
	Mean	Std. Deviation	N	
Imt	19.8025	.98572	8	
Fitness	22.8750	1.24642	8	
Heartbeat	97.8750	.64087	8	
Correlations				
		IMT	TKJI	Heart_rate
IMT	Pearson Correlation	1	.290	-.264
	Sig. (2-tailed)		.486	.527
	N	8	8	8
TKJI	Pearson Correlation	.290	1	.335
	Sig. (2-tailed)	.486		.417
	N	8	8	8
Heart_rate	Pearson Correlation	-.264	.335	1
	Sig. (2-tailed)	.527	.417	
	N	8	8	8

From the results of analysis using SPSS with the crosstabulation method, it can show descriptions, namely the mean Body Mass Index (BMI) 19.8025, the mean fitness 22.8750, and heart rate 97.8750. The results of pearson correlations from BMI with BMI value 1, Fitness with Fitness value 1, Heart Rate Frequency with Heart Rate Frequency value 1 it can be said that these 3 variables have a correlation relationship.

## Significant value

BMI and Fitness show  $0.486 > 0.05 =$  insignificant

BMI and heart rate frequency  $0.527 > 0.05 =$  insignificant

Fitness with a heart rate frequency of  $0.417 > 0.05 =$  insignificant

From these data it can be concluded that from the significant value between the 3 variables is  $> 0.05$ .

In the table correlation level and relationship level.

- a) BMI with Fitness with a result of 0.290 in the weak relationship level category.
- b) BMI with a heart rate frequency with a result of -0.265 is not in the category of correlation rate and relationship level because BMI and heart numbers are not included in the correlation value.
- c) Fitness with a heart rate frequency with a result of 0.335 in the weak relationship level category.

From the results of the data above, it can be seen that the results of many insignificant factors are mainly influenced by dietary factors (inadequate athlete nutrition), the information is obtained from the results of athlete interviews. Another factor that affects this is the level of fatigue of athletes from moderate to high because most are still students who spend a lot of time in school.

## Discussion of Research Results

- a) Correlation of Body Mass Index (BMI) with Heart Rate Frequency with a result of -0.264. If BMI increases it will be inversely proportional to the frequency of heart rate that will decrease and if body mass index decreases then the frequency of heart rate increases. From this statement because good body condition affects the frequency of heart rate. There will inevitably be a decline in students' physical health as they focus less on home workouts, which will affect their strength and cardiovascular fitness in particular. This circumstance will also lead to an increase in the proportion of students who have an overweight body type (Dwi Nugroho, Mintarto, and Khamidi 2021).
- b) Correlation of body mass index (BMI) with fitness with a result of 0.486. If his body mass index rises, his fitness will decrease and if BMI decreases, his fitness will increase, this is because the more abnormal his body condition will be difficult to move or fatigue quickly. Low or abnormal nutritional status will have an impact on physical fitness levels (Istiqomah, Kristiyanto, and Ardyanto 2021).
- c) Correlation of fitness and heart rate frequency with a result of 0.417. If his body fitness increases then the frequency of his heart rate decreases and if his fitness decreases then the frequency of his heart rate will increase. From this statement because if the fitness is good, the frequency of the heart rate to pump blood and oxygen in the body will also work well. Pulse indicator of rest in daily activities. The findings of this study show that the ability of the heart, lungs, and blood vessels to function well when carrying out daily activities for a long time without feeling tired during the day. Heart rate detects the number of cardiovascular repetitions (Palar, Wongkar, and Ticoalu 2015).

## DISCUSSION

From the results of the study, it can be concluded that the majority of male volleyball players at SMAN 4 Madiun City have normal nutritional status and good body fitness levels. These findings are in line with previous literature emphasizing the importance of adequate nutrition and regular physical exercise in supporting athletes' health and performance (Brumitt et al. 2021; Rabbani et al. 2021). However, there was a small percentage of players who experienced mild underweight, suggesting the potential for increased nutrient intake or a more intensive exercise program for that group. Heart rate frequency measurements also showed a reasonable response to physical activity, indicating good cardiovascular adaptation in the school's male volleyball players (Vander Doelen and Scott 2020; Maksum and Indahwati 2023; Moghdani et al. 2020).

The implications of these findings can be used to design more effective and sustainable athlete coaching programs at SMAN 4 Madiun City. Coaches and medical staff can use this data regarding nutritional status, fitness, and cardiovascular response to tailor training and nutrition programs to suit the individual needs of the players. In addition, a better understanding of these health factors can also help in the prevention of injuries and health problems that may arise during practice and competition (Bittencourt et al. 2022; Patterson et al. 2021; Tooth et al. 2023). Further studies can also be conducted to explore other factors that affect athletes' health and performance, as well as to expand our understanding of the complexity of the relationship between nutrition, body fitness, and cardiovascular response in the context of men's volleyball.

From the results of this study, it can be interpreted that male volleyball players at SMAN 4 Madiun City generally show adequate health conditions. The majority of them had normal nutritional status, indicating the existence of understanding and good nutritional practices among this group. This condition is important because adequate nutrition provides a solid foundation to maintain endurance and support the recovery process after training or matches. Nevertheless, the presence of a small percentage of players who experience mild underweight indicates the need for special attention to nutritional intake and perhaps the need for individually tailored nutrition programs.

Physical fitness test results showed that the majority of men's volleyball players were in the excellent category. This confirms that they have an adequate level of body fitness to deal with the physical demands of training and matches (Karagiannakis, Athanasopoulos, and Mandalidis 2018; Umek and Kos 2020). A good level of fitness is not only important for the performance of athletes, but also for preventing injuries and minimizing fatigue during sports activities (de Arruda et al. 2019; Cencini et al. 2023; Zhang and Zhong 2021). Therefore, these results give a positive indication of the effectiveness of the exercise program implemented in the school in improving the fitness condition of the male volleyball players.

Nevertheless, although the majority of players show a reasonable cardiovascular response to physical activity, it should be noted that an increase in heart rate frequency after exercise may indicate additional stress on the cardiovascular system (Biçer 2021; Biese et al. 2020; Singh and Wulf 2020). This highlights the importance of continuous health monitoring and proper exercise management to prevent overtraining or risk of cardiovascular injury (Johansen et al. 2023; Mintarto and Fattahilah 2019). Therefore, an in-depth interpretation of the results of this study emphasizes the need for a holistic

approach in athlete coaching, where physical health, nutrition, and body fitness are the main focus to ensure the athlete's well-being and optimal performance.

In the context of data comparison and comparison, the results showed an alignment between nutritional status, body fitness, and cardiovascular response in male volleyball players at SMAN 4 Madiun City. With the majority of players demonstrating normal nutritional status and good fitness levels, a reasonable cardiovascular response after training indicates that the training program implemented at the school is successfully creating an environment that supports the development of athletes' health and performance. Despite the presence of some players who experienced mild underweight, the overall results of the study showed that the male volleyball players at the school had adequate health conditions and sufficient fitness levels to respond effectively to the demands of the sport. This underscores the importance of a holistic approach in athlete coaching, where physical health and nutrition are key factors in ensuring optimal performance and well-being of athletes.

## CONCLUSION

Research analyzing nutritional status, body fitness, and cardiovascular response in male volleyball players at SMAN 4 Kota Madiun, as well as the results of research that showed the majority of players had normal nutritional status, good fitness levels, and reasonable cardiovascular responses, it can be concluded that the exercise program and health approach implemented at the school has succeeded in creating an environment that supports the overall well-being and performance of athletes. Thus, a very strong conclusion from this study is that health maintenance, proper nutrition, and targeted exercise are the main keys in achieving well-being and optimal performance for male volleyball players in a high school environment. By strengthening understanding of the relationship between these aspects, more effective and sustainable athlete coaching programs can be designed, which not only improve athletes' performance, but also ensure their long-term health.

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